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EMBOLISM OF THE ARTERIES OF THE EXTREMITIES.

BY

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INFIRMARY.



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THE following case occurred in the writer's practice last summer; and the rarity of such, together with the poverty of the literature of our own language on the subject, are his reasons for offering this paper for publication.

CASE I. *Heart-Disease of Sixteen Years' Standing; Sudden Occlusion of Right Popliteal Artery, after an Attack of Endocarditis; Apparent Improvement, and Attempt at Collateral Circulation for Two Days; Secondary Thrombosis of Femoral Artery, extending as high up as Poupart's Ligament, at least, and occluding all the Collateral Branches; Gangrene of Leg on Fourth Day; Double Diaphragmatic Pleurisy and Trismus on Eleventh Day; Death on Twelfth.*—D. P., aged thirty-two, Irish, married, plasterer by trade; has never had rheumatism, syphilis, or any serious illness, except intermittent fever about fifteen years ago, and diphtheria eight years ago. When sixteen years old he was first told by his physician that he had heart-disease, the character of which was not stated, and was advised to give up hard work and avoid excitement. The diagnosis has been frequently verified

by others, and he has been obliged to quit work for an hour or two at a time, but no longer, on two or three occasions.

August 6, 1873.—Was first called to see this patient, and found his stomach largely distended with gas, bowels somewhat tympanitic, pulse 150, irregular, and intermittent. He was belching up a great deal of wind, and suffered slightly from dyspnoea. As he had undergone no unusual exposure, exertion, or excitement, and had been drinking freely for some time of lager-beer, which had disordered his stomach, and interfered with his appetite, it was thought that the derangement of digestion was, perhaps, the main cause of his trouble, and a mixture of hydrocyanic acid, pepsine, and bismuth, was ordered.

7th, Morning.—Felt much better until latter part of night; stomach in better condition, but bowels constipated; pulse 120, and stronger. Examination of heart revealed hypertrophy of left ventricle, with dilatation, and some valvular disease, of the exact nature of which I could not be certain, on account of the rapid and irregular action of the organ. Prescribed cathartic of rhubarb and magnesia, and ten drops of tincture of digitalis every four hours.

Evening.—Bowels have moved, and feels more comfortable.

8th.—Extreme suffering from dyspnoea during past night. Urine examined and found normal; no oedema of lower extremities at any time. This morning Prof. A. L. Loomis saw him in consultation; confirmed the previous diagnosis, and added, as the nature of the valvular trouble, aortic obstruction, aortic regurgitation, and mitral regurgitation, and endocarditis was also supposed to exist. A purge was ordered of ten grains each of calomel and rhubarb, with five grains of quinine. For the tincture of digitalis we substituted tea-spoonful-doses of the infusion of the fresh leaves, with eight grains of bitartrate of potash, every two hours.

11th.—Patient has improved steadily since last date, and ate, with relish, a beefsteak for his dinner at 12 m. to-day. Bowels quite loose. At 1.30 p. m. I was sent for in haste; but, being out at the time, did not see him till 2.45. In the mean time Dr. Cole had been called in. I found, on reaching his

bedside, that at half-past one, while walking across the floor, he had experienced a sense of numbness in the right leg, remarking that he had no control over it. This was followed, almost immediately, by exceedingly acute pain in the muscles of the calf, compelling him to lie down. Dr. Cole at once directed the limb to be bathed in hot mustard-water and vigorously rubbed, and had given him twenty drops of Magendie's solution, and twenty grains of bromide of potassium, with the effect of only partially easing the pain.

Examination of the limb on entering the room showed me that the muscles were perfectly flaccid; the skin was white as marble, and apparently as bloodless; and the surface, from a hand's breadth above the knee to the extremity of the toes, perfectly cold. Pulsation could be felt in both tibials of the left limb; on the right side no pulsation could be felt below the opening in the adductor magnus, for the passage of the femoral. The popliteal could not be felt on either side, on account of the muscularity and fatness of the patient. Dr. Cole says that, when he first examined the limb, the muscles of the calf were hard and contracted, and that there were well-marked muscular twitchings. These disappeared after the first dose of morphine. The limb lay on its outer aspect, was flexed at the knee, and at certain points the epidermis had been separated by the friction. Sensation was very much diminished, if not absolutely destroyed; and it was only after repeated efforts, and with considerable pain, that the patient was able to make the least movement of any portion of the limb below the knee. An effort to straighten the limb caused excessive pain. The patient's general condition was indicative of acute suffering. His head and upper extremities were bathed in perspiration, and he tossed about the bed incessantly, begging some one to shoot him to put him out of his pain.

The diagnosis was made of embolism of the right popliteal artery by a clot or vegetation, from the valves of the heart. The immediate indication was, to relieve the pain; the danger, that of gangrene and its complications.

To ease the patient, it was necessary to give two grains of morphine, hypodermically, in the course of two hours, in fif-

teen-drop doses at intervals of twenty minutes. The limb was wrapped in cotton-wadding, bottles of warm water placed near it, and the patient directed to keep as quiet as possible.

Dr. Loomis saw the patient again at 9 p. m., confirmed the diagnosis, and suggested that the morphine might be supplemented from time to time with hourly doses of thirty grains of bromide of potassium. Weak milk-punch was ordered, and, as he was fully under the influence of morphine, as indicated by itching and contracted pupil, no more was given, though he had not yet slept.

12th, Morning.—Comfortable night, sleeping most of the time, ate some breakfast; no headache or nausea. Natural warmth has extended down as far as the knee-joint, and there is great tenderness on pressure in the popliteal region. No redness, swelling, or tenderness, over the femoral vessels. In testing the sensibility of the skin, the line limiting it was found to pass irregularly around the leg, at an average of about four inches below the knee; slight purplish discoloration of the skin, corresponding pretty accurately with the insensible portion, and caused apparently by extravasated blood. Moving the limb caused great pain; but the patient could himself raise the whole extremity without much inconvenience, and without moving any joint below the hip.

Evening.—Patient has eaten moderately during the day and been comfortable. No marked change in limb.

13th, Morning.—Passed a good night. This morning natural warmth has extended down about four inches farther than yesterday; sensation is extending slowly downward, and the discoloration is fading a little above. In other words, there is every appearance that collateral circulation is being established. No arterial pulsation can be felt at a lower point than previously. General condition good; eats well; and sleeps well with the aid of morphine.

At 1 o'clock p. m. Prof. H. B. Sands saw the patient in consultation, and we concurred in a favorable prognosis as to the salvation of the limb, grounded on the facts above stated.

14th.—Condition of limb slightly worse. Discoloration deepening and extending, and above it is a zone, about six inches wide, of hyperesthesia. General condition good in

every respect. *No pulsation can be felt in the femoral below the middle of the thigh.* Heart's action less regular and weaker. Morphine again; and prescribed digitalis, and two grains of quinine every two hours. Ordered plenty of strong beef-soup, or mutton or chicken broth, milk and eggs, and half an ounce of brandy every two hours.

15th.—Patient worse, weaker and delirious. *No pulsation can be felt in the femoral even at the groin.* There seems to be thrombosis of the artery extending upward from the occlusion. Dr. Sands saw the patient again, and it was found that a surgical needle could be run its entire length into the calf of the leg without the patient's knowledge, and that no blood followed its withdrawal. The prognosis had therefore to be modified; the patient must necessarily lose his limb, and little hope was entertained of his recovery. A proposition for immediate amputation was unhesitatingly rejected. Carbolic-acid ointment to combat gangrenous odor.

16th.—Little change; delirium less. Phlyctenulae appear on gangrenous skin, filled with dark-colored serum. Urine again found normal.

17th.—Worse; incessant incoherent talking, and picking at the bedclothes. Tongue coated, but not dry; no sordes. Limb about the same. Seemed for the first time to have fever; temperature 99.6° in axilla. Brandy increased to an ounce and a half every two hours, and all the nourishment ordered that he could take.

18th.—Stronger and less delirious. Bowels have moved well. Temperature 99.2°.

19th.—No important change. Line of demarcation indicated by enlarged blood-vessels at a hand's-breadth below the knee. Slight erysipelatous blush on outer side of knee, which was painted with iodine, and five drops of the tincture ferri chlor. was ordered every two hours.

20th.—No change.

21st.—Very restless night; delirium worse; pain more severe, and met by morphine. Erysipelas disappearing.

22d.—Miserable night on account of pain. Delirium worse, and of lower type. Detected a commencing pleurisy at base of left lung. At noon he was unable to open his mouth,

or protrude his tongue in the usual manner; respiration 60 per minute and shallow; temperature 104.5° . At 5 o'clock p. m. Dr. J. R. Leaming saw him in consultation, and found diaphragmatic pleurisy on both sides; confirmed the diagnosis of aortic obstruction and regurgitation, but could find no mitral disease. Agreed to give him thirty grains of calomel; but when an effort was made to do so it was found impossible on account of trismus. At 9 o'clock p. m. he could recognize no one, was restless, but not suffering.

23d.—At 2 o'clock A. M. he died, perfectly quietly.

On account of the feelings frequently expressed by the patient during his lifetime, it was impossible to obtain permission to make any *post-mortem* examination whatever—a circumstance much to be regretted. The symptoms, however, are so clear that there can be no reasonable doubt of the diagnosis.

For the history of the literature of this subject the reader is referred to M. Dumaz's "Thesis for the Degree of Doctor of Medicine," Paris, 1872; and to a paper by Dr. John A. Lidell, of this city, in the *American Journal of Medical Sciences*, January, 1873, page 37. Those who have contributed most to elucidate it, and the kindred subject of thrombosis, are Dupuytren, Cruveilhier, Virchow, Carswell, Legroux, Billroth, and Cohnheim.

Etiology.—There is no doubt that disease of the left side of the heart is the principal cause of embolism in the systemic circulation. We have only been able to find one case recorded as the latter, in which the former was not known to exist, and in every case in which an autopsy was made the diagnosis was verified. In the exceptional case¹ the occluding body was a portion of an atheromatous patch on the abdominal aorta, which lodged at the bifurcation of that artery, and occluded the left primitive iliac.

Now, rheumatism is recognized as being the chief cause of heart-disease; but it will be noticed that, in the case which is the foundation of this paper, there had been no previous attack of this nature; and the comparison of some twenty-five published cases shows that *chronic* endocarditis is more likely to cause the accident than the acute form which accompanies

¹ "Thèse de M. Ch. Benni," Paris, 1867.

rheumatic fever. After chronic endocarditis, the result of no special disease, follows acute rheumatism; then the puerperal state; and lastly gout, pleurisy, and the abuse of alcoholic drinks.

In this connection an interesting question arises: Why does gangrene so frequently follow embolism, while ligature of the same artery at the same point is comparatively free from this danger? The explanation is, that in the case of ligature the thrombus, which immediately forms, extends no farther than to the nearest collateral branch; while in a case of embolism the previously diseased and weakened heart propels the blood with so much less velocity, and under so much less tension, that the collateral arteries are not well dilated; and again, the thrombus, which forms above the occlusion, extends upward, constituting what is known as secondary arterial thrombosis, and occludes the collaterals. In the case here reported, the progress of this complication, and its direct influence on the condition of the limb, were plainly noted at the time.

Embolism occurs more frequently in females than males; is most common between the ages of twenty and forty, but by no means restricted to that period; and is more frequent in the lower extremity than the upper, and somewhat more so on the left side than the right.

Pathological Anatomy.—Virchow, Panum, Weber, Billroth, and Cohnheim, have taught us most on this head. The researches of the latter¹ are the most recent that have been published. They confirm previous conclusions in many respects; but show, on the other hand, that haemorrhagic infarction is due, not to collateral arterial fluxion, as Virchow and Rindfleisch teach, but to a retrograde movement of the blood in the veins of the affected district; and, further, that the escape of blood takes place through the mechanically intact walls of the vessels, and not subsequent to a rupture of the latter. The result of embolism is shown to be serious if the occluded vessel is a terminal one; and may be slight if it receives collateral branches beyond the point of occlusion.

An autopsy in case of death, soon after embolism, shows the light-yellow, firm, fibrinous clot which caused the obstruc-

¹ "Untersuchungen über die embolischen Processe," Berlin, 1872.

tion, situated usually, though not always, at the bifurcation of an artery. Above and below this, the vessel is filled with a soft, dark-colored clot, the length of which depends upon circumstances. If circulation has been re-established, it extends in both directions to the point where a collateral branch is given off or received; if no attempt at collateral circulation has been made, it extends downward to the termination of the artery, and upward to an indefinite distance; frequently, in the lower extremity, as far as the bifurcation of the common iliac, or of the aorta itself. The vein corresponding to the obliterated artery is sometimes filled with coagula, sometimes free.

An autopsy months after embolism, and when the vitality of the limb has been preserved, will show the same conversion of the vessel into a fibrous cord which follows the ligature. It is also possible¹ that, "if the embolus consists of pure fibrine, it may be dissolved;" in which event no lesion would be found to show that the accident had ever occurred.

One important step in the organization of the embolus, and the conversion of it, together with the wall of the vessel, into a fibrous cord, is *acute secondary endarteritis*. In autopsies, made some days after the embolism or thrombosis, this condition is frequently found, and was formerly supposed to be the cause of the trouble; it is now shown to be part of the process which Nature adopts to remedy the mischief.

Diagnosis.—This is usually easy. The symptoms are, first, an unusual sensation in the limb, suddenly developed, generally amounting to pain so acute as to be the prominent symptom; occasionally it is described as simply an itching, prickling, formication, or numbness. Frequently this comes on in the midst of apparent good health. In one case M. Legroux² noticed the disappearance of a bellows-murmur in the heart at the time of the occurrence of the embolism; in our own case the mitral-regurgitant murmur seems to have disappeared. It is suggested that the same explanation may be offered for both; viz., that the fibrinous accretion which gave rise to the murmur became, by its detachment, the embolus.

To this unusual sensation is added *paralysis*, more or less

¹ American translation of Billroth's "Surgical Pathology," pp. 325, 326.

² "Thèse pour le Doctorat en Médecine," quoted in Dumaz's thesis.

complete, of the limb, and to this also the patient usually calls attention.

The third symptom is *decrease or abolition of sensation*. All of these symptoms might occur with paralysis from disease or injury of the nervous centres.

When one adds to these, however, the three symptoms dependent on mechanical obstruction in the vessel—*paleness, coldness, and absence of arterial pulsation below the affected point*—we have a group of phenomena which belong to embolism and nothing else. As occasional symptoms we may also add nausea, vomiting, and muscular twitchings. The physiognomy of the patient is usually indicative of a serious lesion.

The after-history of the case depends, of course, upon the result. If death ensues, the paleness of the limb gives place in from two to six days to violet discoloration, and the rest of the history is simply that of gangrene. The line of demarcation is rarely situated at the level of the embolus, but usually much lower down. It is not uncommon, with gangrene extending only to the knee, to find occlusion at the bifurcation of the common iliac. Another point well worthy of note is that the constitutional symptoms are for many days so slight as to delude the patient and his friends into the belief that the lesion is not nearly so serious as the physician knows and states it to be. From ten to fifteen days frequently elapse before the thermometer indicates any constitutional disturbance, and during this period appetite and digestion are usually good.

If recovery follows embolism, all the symptoms gradually disappear as collateral circulation is established; and pain is spontaneously developed in the course of the affected artery, due to the arteritis already mentioned. Sometimes, however, circulation returns much more rapidly than would be possible through collaterals. M. Hallopeau records a case in which this occurred while he happened to be examining the affected limb. The color returned as rapidly as if a fine injection had been thrown into the main artery, an hour and a quarter after embolism had taken place, accompanied by natural warmth which soon became excessive; and at the end of three hours all the symptoms had disappeared. Disintegration and solution of the clot could alone account for this.

Many mistakes in diagnosis in this affection have been made, due in part to the fact that the pathology of the lesion has only recently been made out. A no less celebrated man than Cruveilhier¹ admits having fallen temporarily into error. The subject which he is discussing is gangrene by cadaverization, and the first paragraph reads as follows:

"In this form of gangrene the dead parts present the appearance of a fresh cadaver, or of a recently-amputated limb. It is observed particularly in the case of the death of a limb by sudden and complete intercession of arterial blood. Such was the case of a female, aged forty, suffering with cancer of the breast, who was suddenly seized with paralysis of sensation and motion in the whole left lower extremity. I thought at first that I had to deal with a case of paralysis, and therefore had the limb warmed with hot linens, and friction made with spirits. But soon afterward, struck with the death-like coldness of the limb, with its cadaverous paleness, which extended to the groin and ceased abruptly with the paralysis; and having noticed, besides, that, at certain points, the friction had detached the epidermis, I at once recognized my error, and diagnosticated the form of gangrene which I have thought proper to call *gangrene by cadaverization*; which the result was not long in confirming."

Cruveilhier, then, recognized that this form of gangrene was due to obstruction of the main artery of the limb; but the migration of the occluding embolus from the heart was an important point in the history of the disease which had not then been grasped.

The records of the New York Pathological Society, and the medical journals of a few years past, both in this country and Europe, afford a number of cases that would be of interest in this connection did they not occupy so much space.

One more point must be noticed, which is, the frequency of relapse; or, more correctly speaking, the probability that, after one artery has become the seat of an embolus, others will share the same fate. Schutzenberger² records an extreme instance of this kind, in which there occurred, first, embolism

¹ "Anatomie Pathologique," Paris, 1862, p. 252.

² *Gazette Médicale de Strasbourg*, 1857, p. 110.

of the left brachial, followed by restoration of the circulation ; forty days afterward, obliteration of the bifurcation of the aorta, followed by establishment of collateral circulation ; fifty-four days later, hemiplegia ; and, six days after that, sudden death, which was found to depend on softening of the brain, the result of plugging of the right internal carotid. Infarctions were also found in the liver and spleen.

Prognosis.—From what has been already said, it is clear the prognosis is bad. The physician must always be sure that the heart is restored to a healthy condition before the patient can be pronounced out of danger. The writer has been able to find but one recovery in thirty published cases. It is probable that other cases have recovered, the histories of which have never been published, owing to the doubt that has always been supposed to hang over the diagnosis. To the kindness of our friend Dr. Wm. M. McLaury we owe one such :

CASE II.—Mrs. M., American, aged thirty-one, married, having always enjoyed fair health, went through her first and second pregnancies and confinements without any unusual occurrence. Had never had any heart-disease. Twenty-four hours after her second labor, which occurred on January 10, 1865, she had a severe chill, and two or three hours later was suddenly seized with intense pain in the right leg, which soon amounted to *perfect agony*. On examination the foot and leg were found to be very pale up to a line about three inches below the knee, and through the same extent coldness, with a very great diminution, if not total absence, of sensation, was noticed. Unfortunately, the arteries were not examined with reference to their pulsations. The power of voluntary motion was abolished, and there was a single purplish streak from the knee down the outer side of the leg on to the foot.

Two days later, phlyctenulæ made their appearance on the skin, which had then become gangrenous, and the integument sloughed off until the muscles, tendons, ligaments, and bone, were all exposed from two or three inches below the knee down to the line of the metatarso-phalangeal articulations, leaving only a narrow strip of skin with irregular borders, corresponding to the previously-mentioned purplish line. The limb was kept covered with yeast-poultices and lying in a bed

of bran. The internal treatment was supporting and stimulating, the patient's daily allowance being four pounds of fresh, lean beef made into strong broth; three eggs and a sufficient quantity of milk made into punch; and, as stimulants, one quart-bottle of brandy, one-half pint of sherry, and one pint of champagne—the latter to control nausea. The patient also frequently took as much as four ounces of laudanum in the twenty-four hours to relieve pain.

One month after the accident the slough had separated and granulations appeared; at the end of three months she was able to leave her bed; at the end of five months began to go out-doors; gradually her health was fully restored; and at present a large scar is to be seen, and a granulating surface, rather smaller than a silver dollar, which has never healed.

The lodgment of an embolus at the bifurcation of the popliteal, so disposed as to entirely occlude the anterior tibial, and diminish the flow through the posterior, would account for just what took place in this case.

Treatment.—When embolism of the main artery of an extremity has taken place, it has been proposed to make an effort to break up the clot by kneading the affected part, and thus allow the fragments to pass into vessels of less importance and facilitate their solution. The writer cannot find that success has ever attended such efforts.

It has also been recommended to administer carbonate of ammonia in pretty large doses, with a view of dissolving the coagulated fibrine; and Dr. Richardson claims that he has met with considerable success in thus effecting solution of emboli of the pulmonary artery.

At all events, the warmth of the limb must be maintained in order to assist the formation of collateral circulation, except in those cases in which, as Otto Weber points out, there is danger from venous hyperæmia and thrombosis; then cold and astringent lotions should be resorted to, first among which he classes lead-water.

At the same time we must not forget the great importance of the heart complication which usually exists, and impart to the contractions of that organ additional strength and tone by whatever means each may consider most expedient. Digi-

talis and alcohol will probably occupy the first rank among these in the estimation of all.

If all these means have failed to maintain the vitality of the limb, the question of amputation comes up. The danger of septic poisoning stares us in the face, so long as the dead parts are in contact with the living; and, if our patient is fortunate enough to escape that, there follows the exhaustive process of ulceration and suppuration by which Nature removes the gangrenous limb, and cicatrizes the stump. For these reasons M. Dumaz advises the amputation of the extremity just as soon as gangrene declares itself by the appearance of violet marbling on the previously pale limb.

We are unable to find any case recorded in which amputation has been performed at this early period, before the line of demarcation is formed.

The two latest works on surgery which are supposed to contain, in a comparatively small compass, the results of all past experience, as well as of the most recent scientific research, are Pitha and Billroth's "Handbuch der Chirurgie," and Holmes's "System of Surgery." In the first of these Otto Weber says,¹ "The amputation of gangrenous parts should, as a rule, never be undertaken until the line of demarcation of the gangrene is plainly marked out by Nature; even then it consists often in only an unimportant assistance, in that one only divides the firmer tissues." The reason given for this rule is, that the flaps are so very apt to slough.

In Holmes's "System of Surgery," Chas. H. Moore, in an article on "Gangrene from Occlusion of Arteries,"² asks, "Should the gangrenous limb be amputated?" and answers, "Surgical experience and reasoning both prompt a general reply in the negative." His reasons are, that the occlusion is frequently at a point higher than the proposed amputation, that gangrene is very apt to occur in the flaps, and that the result of amputation is in general fatal. The vast majority of our American surgeons entertain precisely similar views in regard to gangrene in general.

The best argument in favor of very early amputation in

¹ *Op. cit.*, I. Band, I. Abth., I. Abschnitt, S. 566.

² Vol. iii., p. 407.

this particular case is, that the great danger in waiting lies in the extreme probability of secondary arterial thrombosis occurring, with the embolus as a starting-point; and that by removing the limb early, and at a point sufficiently high to include the embolus, this may be averted. The theoretical reply would be, that a thrombus would immediately form at the point of ligation of the vessel in the amputation, and would be just as likely to extend upward to a fatal distance as that which started from the original embolus, under the given conditions of a weakened and diseased heart. If, in reply, it be urged that nothing can be supposed to diminish the chances of recovery after gangrene has fairly set in as a consequence of embolism in a patient with chronic heart-disease, we have nothing to say, except that in many cases where the occlusion exists at the bifurcation of the common iliac or of the aorta, it will be impossible to include the embolus in the amputated limb. That delay is not necessarily fatal, is shown by the fact that Bryant, of Guy's Hospital, has twice successfully amputated the leg, in consequence of gangrene from embolism occurring in the course of scarlet fever, after the line had formed.

To condense into a single paragraph the conclusions which may fairly be drawn from what has preceded, we may say that arterial embolism may be looked for especially in patients who have long been suffering from heart-disease, and generally between twenty and forty years of age; that the diagnosis is generally easy, paleness, coldness, and absence of arterial pulsation in an extremity, being added to the symptoms which usually accompany paralysis; that the prognosis is very bad; and, finally, that the treatment consists in an effort to break up the clot, if the artery be superficial, or effect its solution, to favor the formation of collateral circulation, and to omit no measures tending to strengthen and regulate the heart's action, and nourish and support the patient. Amputation is unavoidable until the line of demarcation has formed and extended deep into the soft parts, unless the attempt be made to thus save the patient's life, just at the time when gangrene is evidently impending, and secondary arterial thrombosis has not yet extended upward to the point where the artery would be divided in the operation.

In concluding this paper, the writer would like to call attention to the differential diagnosis between arterial thrombosis and embolism. The symptoms of the latter have been already clearly set forth; the history of the former can be read in any well-marked case of senile gangrene, accompanied by degeneration of the inner arterial coat, rendering it so rough that it readily affords attachment to fibrinous clots.

There are, however, many other cases of arterial occlusion, followed by gangrene, on record, occurring after confinement; during an attack of scarlet fever, with heart-complications; in cancerous patients; during the course of a typhoid or other low form of fever; in cholera; in goitre; in peritonitis, and other diseases—most of which have been reported as cases of thrombosis. The histories of most of these cases read just like those of embolism, and where death has ensued the *post-mortem* examination has usually shown a clot of lamellated fibrine, situated often at the bifurcation of an artery, and no lesion of the arterial walls of such nature as to render probable its existence prior to the occlusion. M. Dumaz puts the argument concerning the point of origin of the clot very clearly, though he was not the originator of it. Considering the pressure of blood in the arteries (amounting to about six feet of water), and the rapidity of the circulation (blood passing from the pulmonary radicles to the extremities in four or five seconds), it is almost impossible to conceive that a clot could form on the healthy wall of an artery; having no inflamed or roughened surface to which to attach itself, it must be washed along in the current. It seems much more probable that the clot forms and grows in the heart, “where every thing is favorable for the production of a fibrinous clot, the chordæ tendineæ, the columnæ carneæ, the play of the valves, the anfractuosities, the irregularity of the contractions, their lack of strength in the puerperal condition, typhoid fever, goitre, and other diseases.” He supposes, then, that the clot having begun to form behind one of the valves, protected in a little eddy, or in a fossa between two columnæ carneæ, grows until, by its increased size, it projects into the cavity of the heart far enough to be detached from its moorings, or a part of it broken off by the current, and carried into the circulation.

Dr. B. W. Richardson¹ claims that fibrinous coagulation in the heart is of comparatively common occurrence before death, especially in diphtheritic croup, gives the diagnostic signs of the accident, and points out the course of treatment to be pursued.

Dr. Barnes² has given us a table of cases of puerperal gangrene, by the remarks appended to which it is clear that he is not decided whether they ought not to be considered as cases of embolism, rather than thrombosis, at least in some instances.

Dr. Beverly Robinson,³ of this city, in a very fair discussion of the probability of the *ante-mortem* formation of heart-clot, supports Richardson's view, and strengthens it by the relation of *post-mortem* examinations in which its character was carefully observed.

So far as we can ascertain, no one has attempted to *prove* that a fibrinous clot ever forms in the calibre of a healthy artery; it has simply been the custom to report the cases, to which we now refer, as instances of thrombosis, depending on extreme coagulability of the blood. If, however, they be classed as cases of embolism, the prognosis previously given must be modified, and made to depend very greatly on the presence or absence of heart-disease of long standing. In twenty-three cases which we have been able to collect, where it was absent, we have ten recoveries; while, in thirty cases in which it was known to exist, we have but one.

¹ *British Medical Journal*, December 14, 1872.

² "Obstetrical Transactions," vol. iv., p. 31.

³ "Thèse pour le Doctorat en Médecine," Paris, 1872.



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